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255803

67,935/60

COMMONWEALTH OF AUSTRALIA

PATENT SPECIFICATION

		Class	Int. Cl.
Application Number Lodged	67,935/60. 29th December, 1960.	19.6.	C03b.

Accompanied by
Provisional Specification.

Complete Specification
Entitled IMPROVED SLAG COMPOSITION AND FIBRES FORMED THEREFROM.

Lodged	28th December, 1961.
Accepted	Lapsed before Acceptance.
Published	4th July, 1963.

Convention Priority -

Applicant INSULWOOL PRODUCTS PROPRIETARY LIMITED.

Actual Inventors GEOFFREY VICTOR CULLEN and REGINALD McPHERSON.

Related Art:

219,769(24,797/57)	19.6.
101,138(4496/36)	19.6; 06.1.
103,795(1573/39)	06.1; 19.6.

The following statement is a full description of this invention, including the best method of performing it known to us :

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67-CD-C11-SP.C.

This invention relates to a slag produced artificially as a raw material for the production of mineral fibres.

Slags used for the production of slag wool and rock wool are proluced by melting lime, sand and other mineral materials in suitable proportions to produce a readily melted viscous slag which may be readily drawn into fibres. However, the known types of slag, when used for known fibre production processes produce an undesirably large proportion of spherical particles or "shot" in addition to the fibrous material.

It has not yet been definitely determined that the proportion of spherical particles is directly related to the composition of the slag used, but experiments have shown that the proportion of spherical particles is controlled, at least to some extent, by the physical properties of the molten slag.

Thus, slages of known composition tend to lose some of their glassy properties at temperatures low enough to provide the required slag viscosity of between 200 and 1000 poise during fibre formation. Moreover, the rate of change of viscosity may not be sufficient to satisfy the conditions required for slag transport to the stage of fibre generation and for fibre attenuation immediately thereafter.

The object of the present invention is accordingly to provide an improved slag composition with physical properties in the molten state such that it will, at least when used in some processes involving centrifuging of the slag from rotating discs or cups, produce mineral wool with a smaller proportion of spherical particles than previously known slag compositions. According to this invention, there is provided a mineral slag containing Al_2O_3, SiO_2 and CaO, with or without MgO or other components, the Al_2O_3 being present in the range 5 - 30% by weight and the Al_2O_3 and

SiO_2 together comprising at least 57% by weight and preferably at least 50% by weight of the composition.

More particularly, a mineral slag in accordance with the invention may be defined in terms of a volume in the SiO_2-CaO-Al_2O_3-MgO composition tetrahedron:-

(i) The volume within the tetrahedron being specified by areas on sections of the tetrahedron corresponding to 10, 15, 20 and 25% Al_2O_3,

(ii) The areas within the sections corresponding to the composition points given in the following table, all the areas being bounded by approximately straight lines.

10% Al_2O_3	MgO	SiO_2	CaO
	5	50	Remainder
	5	57	"
	10	50	"
	15	58	"
15% Al_2O_3			
	2	42	"
	2	50	"
	15	47	"
	15	52	"
20% Al_2O_3			
	0	40	"
	15	40	"
	0	45	"
	15	47	"
25% Al_2O_3			
	0	40	"
	0	38	"
	8	35	"
	10	42	"

In order to more fully explain the nature of the present invention and to define more precisely the range of slag compositions in accordance with the invention, reference will be made to the accompanying drawings, of which:-

Figure 1 is an exemplary representation of temperature-viscosity and liquidus relationships for slag compositions comprising 10% of Al_2O_3 and varying proportions of SiO_2, CaO and MgO,

Figure 2 shows the range of permissible proportions of SiO_2, CaO and MgO for a slag in accordance with the invention containing 10% Al_2O_3,

Figure 3 shows the range of permissible proportions of SiO_2, CaO and MgO for a slag in accordance with the invention containing 15% Al_2O_3,

Figure 4 shows the range of permissible proportions of SiO_2, CaO and MgO for a slag in accordance with the invention containing 20% Al_2O_3, and

Figure 5 shows the range of permissible proportions of SiO_2, CaO and MgO for a slag in accordance with the invention containing 25% Al_2O_3.

For a range of compositions having four components, each of which may be individually varied, all possible compositions may be represented diagrammatically by points within a tetrahedron. The liquidus temperature at which a liquid of given composition will first begin to crystallise under equilibrium conditions is an equilibrium value and not quantitatively significant unless slags are cooled at relatively slower rated than those used in the spinning process. However, the liquidus temperature gives an indication of the relative melting temperatures of different slags. When diagrammatic representation is desired, the liquidus

temperatures cannot be represented by a line or surface within the tetrahedron, but, by taking a section of the tetrahedron at which one component of the slag is held constant, the liquidus surface at a particular temperature may be represented by a line. This has been done in Figure 1 in which a section of the tetrahedron for 10% Al_2O_3 has been taken and the liquidus lines for temperatures of 1300°, 1400° and 1500° are shown.

In Figure 1, lines of constant viscosity for the slag composition at 1400°C. are represented by broken lines, the viscosity values being given in units of poise. The range of slag compositions in accordance with the invention is represented by the shaded area on the graph and it will be apparent that this area is bounded on its upper side by the line for viscosity of about 30 poise, the greatest value of viscosity which has been found to give satisfactory results. The other boundaries of the shaded area do not correspond precisely to the liquidus line for 1300°C. for the reason previously referred to, but do bear an approximate relationship thereto.

Figures 2 to 5 have been prepared on a similar basis to Figure 1 but, for clarity, show only the range of preferred compositions.

Accordingly, a mineral slag in accordance with the invention may be defined as one which contains between 5% and 30% by weight Al_2O_3, and SiO_2, CaO and MgO in proportions within the ranges defined by the shaded areas shown in Figures 2 to 5 of the accompanying drawings which illustrate the compositions for 5% intervals of Al_2O_3 in the range 10% to 25%.

One example of a composition in accordance with the invention is as follows:-

SiO_2	40 per cent by weight
CaO	35 per cent " "
Al_2O_3	20 per cent " "
MgO	5 per cent " "

This composition is particularly suitable for the production of mineral wool according to the process described in our copending application No.67855/60.

However, other compositions may meet the requirements of the present invention and the proportions of the constituents may be varied without department from the desired slag characteristics. Further examples of compositions in accordance with the invention are as follows:-

Al_2O_3	SiO_2	MgO	CaO
10-15	50-55	5-10	Remainder
15-17.5	45-50	5-15	"
17.5-22.5	40-45	0-15	"
22.5-27.5	38-42	0-10	"

It has been found that compositions according to the invention have the correct temperature - viscosity relationships for the production of substantially shotless mineral wool.

The claims defining the invention are as follows:-

1. A mineral slag containing Al_2O_3, SiO_2 and CaO, with or without MgO or other components, the Al_2O_3 being present in the range 5-30% by weight and the Al_2O_3 and SiO_2 together comprising at least 57% by weight of the composition. (29th December, 1960).

2. A mineral slag as claimed in claim 1, in which the Al_2O_3 and SiO_2 together comprise at least 60% by weight of the composition. (29th December, 1960).

3. A mineral slag comprising Al_2O_3, SiO_2, CaO and MgO in proportions by weight defined by the volume bounded by approximately straight lines between the following points of a tetrahedral composition diagram:-

	MgO	SiO_2	CaO
10% Al_2O_3	5	50	Remainder
	5	57	"
	10	50	"
	15	58	"
15% Al_2O_3	2	42	"
	2	50	"
	15	47	"
	15	52	"
20% Al_2O_3	0	40	"
	15	40	"
	0	45	"
	15	47	"
25% Al_2O_3	0	40	"
	0	38	"
	8	35	"
	10	42	" (29th December, 1960.)

4. A mineral slag comprising between 5% and 30% by weight Al_2O_3, and SiO_2, CaO and MgO in proportions by weight within the ranges defined by the shaded areas shown in Figures 2 to 5 of the accompanying drawings and interpolated areas corresponding to intermediate proportions of Al_2O_3 between 10% and 25%, said interpolation being linear between adjacent sections defined by the said Figures. (29th December, 1960).

5. A mineral slag comprising

SiO_2	40 per cent by weight
CaO	35 per cent " "
Al_2O_3	20 per cent " "
MgO	5 per cent " "

(29th December, 1960).

6. A mineral slag comprising 10-15% Al_2O_3, 50-55% SiO_2, 5-10% MgO and the remainder CaO, the proportions being by weight. (29th December, 1960).

7. A mineral slag comprising 15-17.5% Al_2O_3, 45-50% SiO_2, 5-15% MgO and the remainder CaO, the proportions being by weight. (29th December, 1960).

8. A mineral slag comprising 17.5-22.5% Al_2O_3, 40-45% SiO_2, 0-15% MgO and the remainder CaO, the proportions being by weight. (29th December, 1960).

9. A mineral slag comprising 22.5-27/5% Al_2O_3, 38-42% SiO_2, 0-10% MgO and the remainder CaO, the proportions being by weight. (29th December, 1960).

Dated this 22nd day of December, 1961.

INSULWOOL PRODUCTS PROPRIETARY LIMITED
by Its Patent Attorneys

DAVIES & COLLISON

FELLOWS INSTITUTE OF PATENT ATTORNEYS OF AUST. (INC.)

Fig. 1

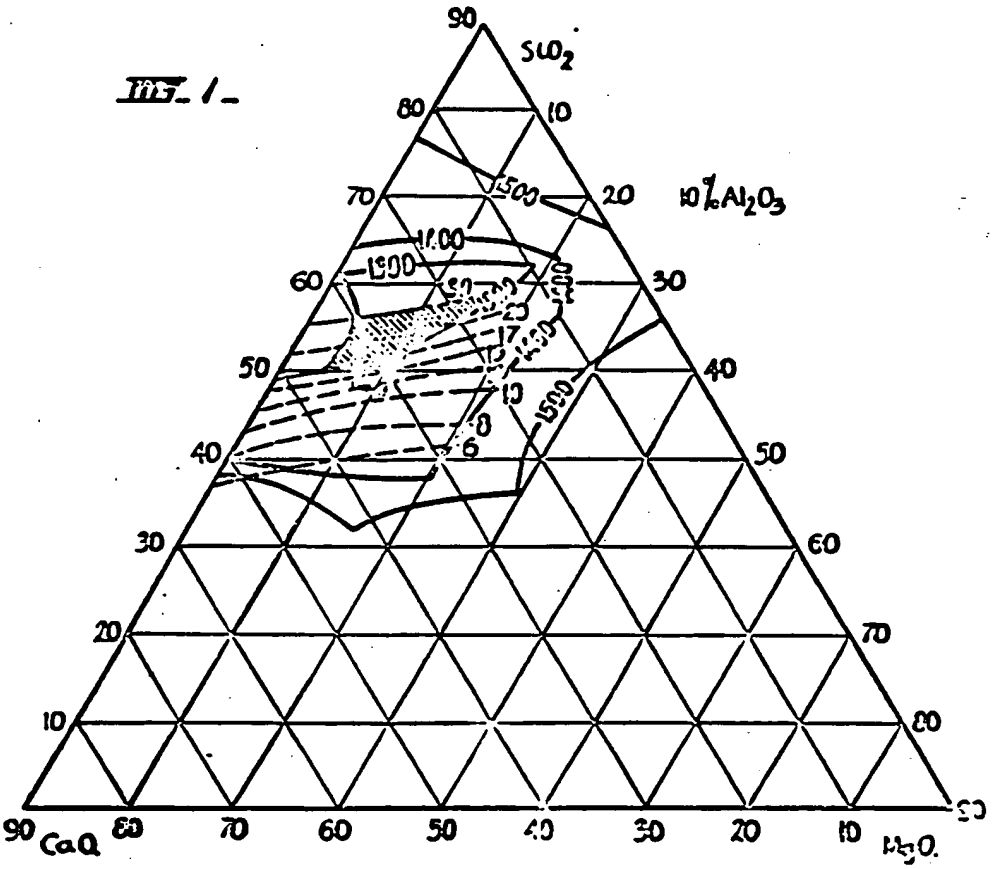
90
SiO_2
80
10
70
20
10% Al_2O_3
60
30
50
40
40
50
30
60
20
70
10
80
90 CaO
80
70
60
50
40
30
20
10
H_2O
1500
1400
1300
1200
1100
1500
17
15
13
8
6

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Fig. 2.

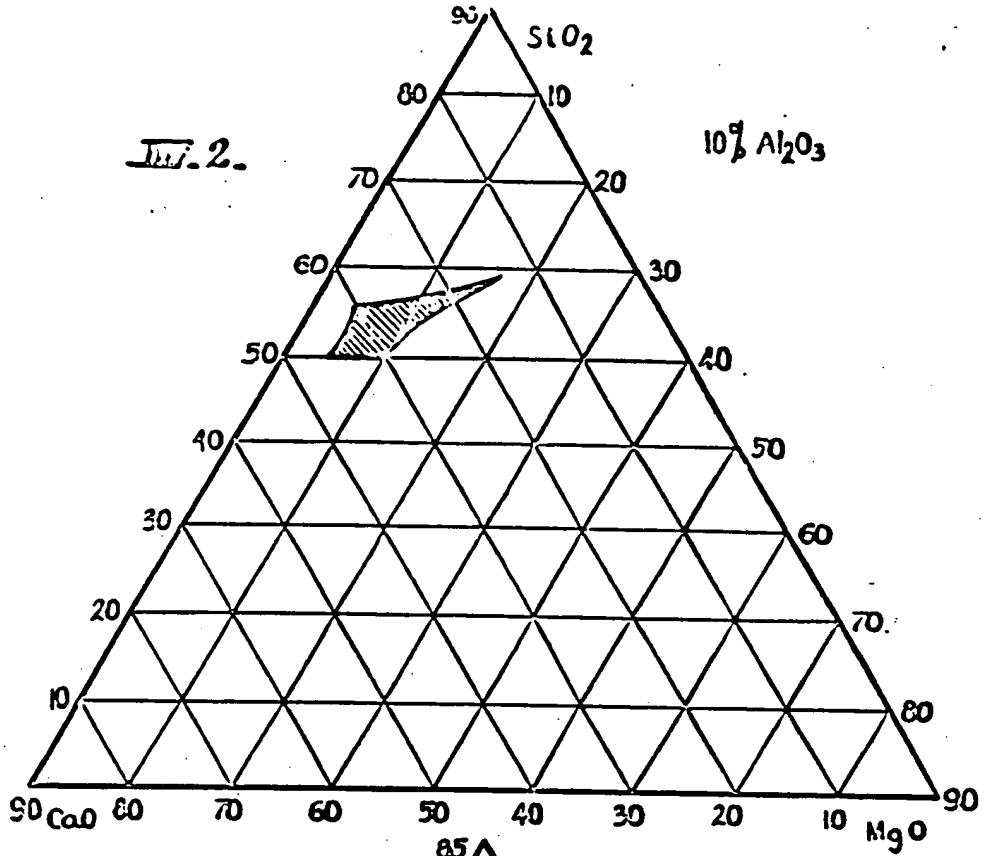
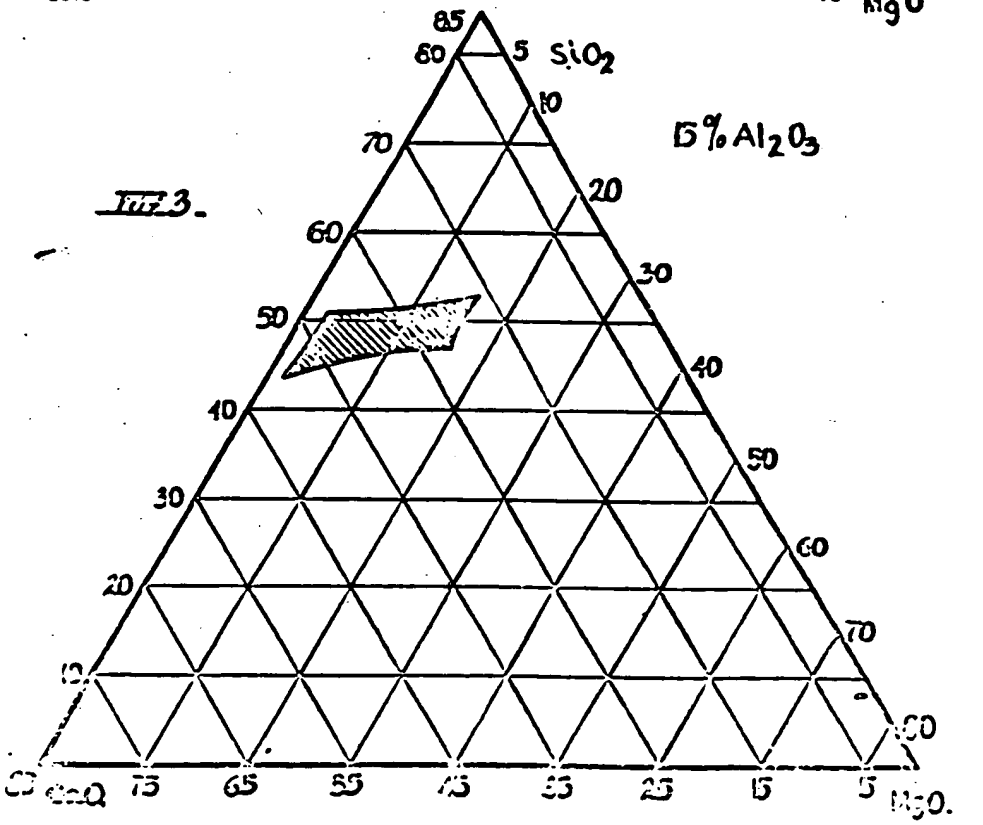


Fig. 3.



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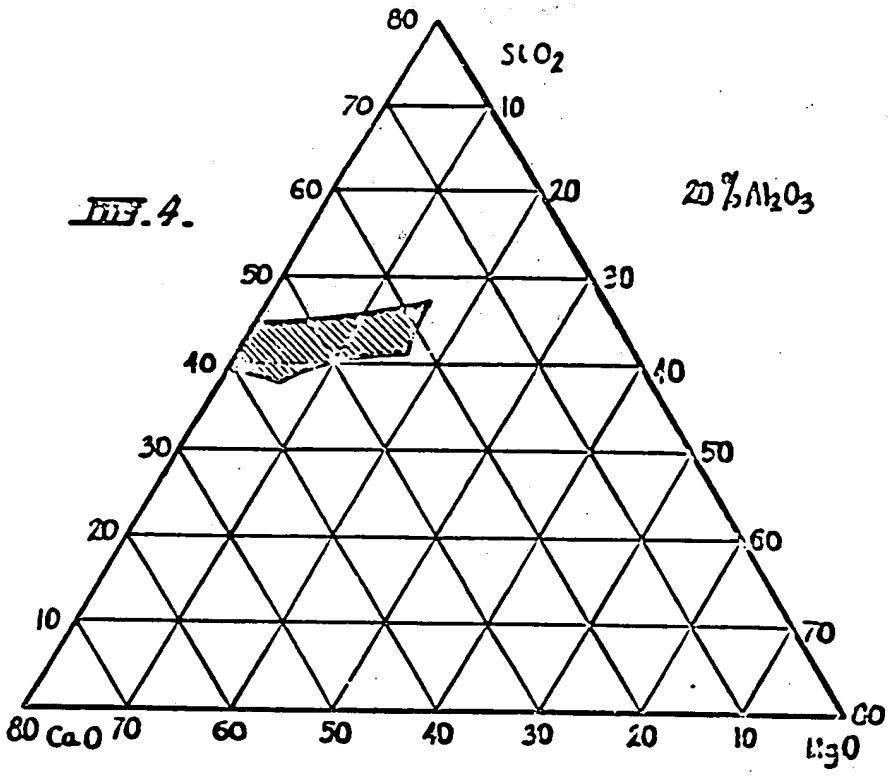
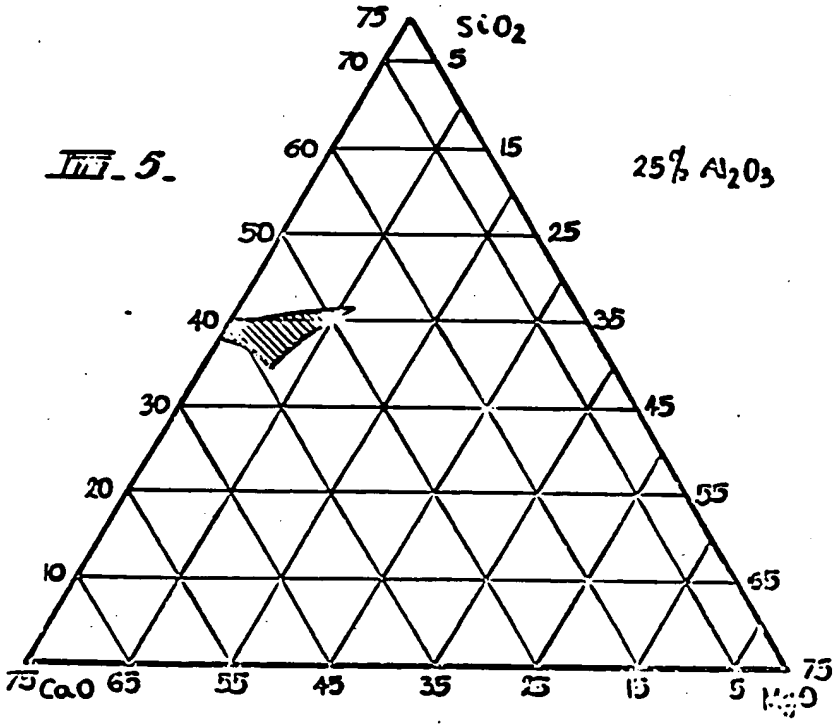


Фиг. 4.



Фиг. 5.